Multi-Center Traffic Management Advisor

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The primary objective of Multi-Center Traffic Management Advisor (McTMA) is to improve the capacity at busy airports that are controlled by more than one Center. This is a common situation in the U.S. Northeast Corridor. Capacity increases are expected as a result of improving the flow of traffic into the airport through better coordination between the facilities. The research and development will initially focus on arrivals to Philadelphia International Airport. As illustrated in the figure, two en route Centers, New York and Washington, feed the Philadelphia terminal area ((TRACON) Terminal Radar Approach Control) and airport, with additional significant interactions with Cleveland and Boston Centers.

Multi-Center TMA is a major extension of the Ames-developed Traffic Management Advisor (TMA) that is currently being deployed as part of the Federal Aviation Administration's (FAA's) Free Flight Phase 1 Program. The TMA is a decision support tool that assists en route traffic managers and controllers in predicting, planning, and controlling arrival air traffic into busy terminal areas. TMA predicts arrival traffic demand, generates efficient arrival schedules to fully utilize a busy airport's capacity, and issues advisories to controllers that aid them in meeting the TMA-generated schedule. The NASA-developed TMA has been operational on a daily basis at the Ft. Worth en route Center for nearly 4 years. The FAA's Free Flight Phase 1 Program is deploying TMAs to seven additional en route Centers. All of the TMA deployments have focused on facilities where a single Center manages arrivals.

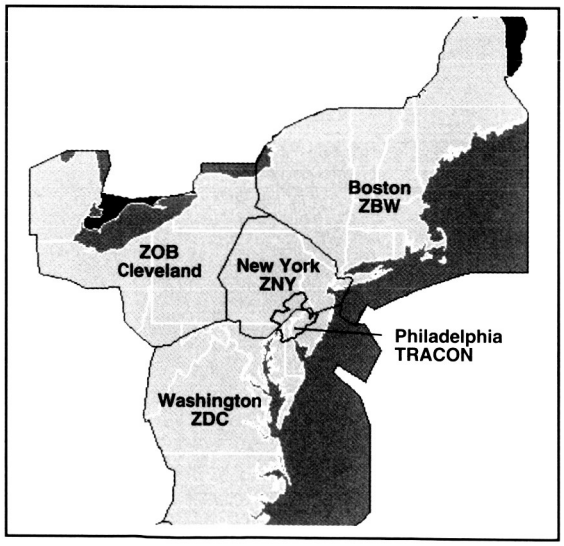

Fig. 1. Northeast Corridor map.

The extension of TMA to a multi-Center environment requires the design, development, and evaluation in simulation and field-test of a multi-facility software architecture and of operational procedures for the collaboration, management, and control of arrival traffic. In order to enhance the technical expertise and ultimate success of the McTMA project, two programmatic efforts were put into place. First, Ames Research Center entered into a cooperative agreement with the Mitre Corporation's Center for Advanced Aviation System Development (CAASD) to conduct joint research on McTMA concepts. The CAASD is a federally funded research and development center that supports the FAA. Second, NASA developed a multi-facility software architecture concept that is the basis of a 4-year, $14 million contract award to Computer Sciences Corporation for the software development of McTMA.

To date, field site surveys of Cleveland, New York, Washington, and Boston Centers and Philadelphia TRACON were conducted in order to understand current operational

procedures and to develop operational concepts for McTMA. Ames researchers used the knowledge gained in the site surveys to adapt TMA to Philadelphia and the surrounding Centers. Ames then conducted a series of real-time simulations—utilizing air traffic controllers and traffic managers from all of the affected facilities—of the arrival traffic feeding through the en route Centers into the Philadelphia TRACON. The results of the simulations defined the requirements for the system software architecture and the arrival traffic scheduling algorithms. Additionally, it was confirmed that because of the narrow geometry of many of the sectors, as well as crossing traffic bound for other busy East Coast airports, delay absorption would need to be allocated sector-by-sector. It was also determined that some delay would have to be absorbed by sectors much farther upstream from the airport than expected. This is caused by the limited delay capacity of much of the airspace.

Additional simulations are planned and will be conducted at Ames and at the FAA's Technical Center over the next year. These simulations will be followed by an operational field test, beginning in early 2002 and lasting through 2004. Following successful completion of the McTMA field trials, the system will be handed off to the FAA for further deployment to selected sites throughout the United States.

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Mitigating Runway Incursions with Cockpit Display Technology

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Between 1988 and 2000 the U.S. Runway Safety Program Office (ATP-20) reported 3,420 runway incursions; 48% of these incursions were caused by pilots deviating from taxi clearances issued to them by air traffic control (ATC). Research at Ames Research Center has been conducted to identify the factors that contribute to these incidents and to develop cockpit display technologies to mitigate these and other errors in order to increase runway safety while simultaneously increasing efficiency.

Two full-mission surface-operations simulation studies were conducted in the Advanced Concept Flight Simulator (ACFS) at Ames. The ACFS was equipped with the Taxiway Navigation and Situation Awareness (T–NASA) display suite, which is composed of an electronic moving map (EMM) and a head-up display (HUD) to be used during taxi (see fig. 1). The EMM presented an over-the-shoulder perspective view of the airport surface, location of own-ship in real time, and the taxi route clearance, textually and

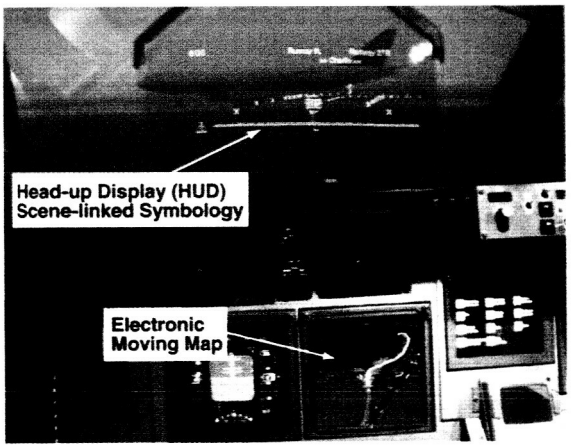

Fig. 1. The T-NASA System consists of an electronic moving map and a head-up display depicting the cleared taxi route transmitted via data-link ATC.